

# Detailed Geoid Creation

*In addition to the standard methods of Geoid creation found in Carlson X-Port, customized geoids can also be created with Carlson Survey.*

Carlson X-Port, the desktop product that accompanies each license of SurvCE provides functionality to create user-specified geoids for a given region. This is accomplished through the SurvCom engine. The resulting geoids are square rather than the more desirable rectangular shape used by most State Plane Coordinate Systems.

## **Purpose of This Chapter**

The purpose of this chapter is to provide an alternative method for geoid creation that involves the use of Carlson Survey. During the process, geoid grid cells will be configured to produce a rectangular-shaped geoid grid.

## **Supporting Geoid Files**

If the geoid files that ship with Carlson X-Port have not already been installed to your computer, follow the steps below to download and install them:

1. Open a web browser and navigate to <http://update.carlsonsw.com/updates.php?product=SurvCE>.
2. Locate the appropriate geoid download option and download to your computer.
3. Once downloaded, double-click on the setup executable to deliver the geoid files to your computer and note the installation path to which the files were installed.

## **Carlson Survey**

Carlson Survey is a fully-featured, desktop/office product used by land surveyors around the world to produce maps and plats commonly generated by Land Surveyors.

## **Download and Install**

If it has not already been purchased separately, download and install a 30-day trial version of the product:

1. Visit your local authorized Carlson Dealer and inquire about a demonstration copy of the product, or, open a web browser and navigate to <http://www.carlsonsw.com/demosurvey>.
2. Complete the requested information and submit the registration data. A 30-day evaluation code and product information will be sent to you.

3. Install Carlson Survey to your computer and launch it from the icon installed to your PC.

**Create a Working Drawing**

Menu Location: File ⇒ New  
 Keyboard Command: new

1. Open into a drawing (blank or otherwise) that will serve as a graphical “container” for your geoid work area.

**Note**

It is strongly recommended you work through the first two or three tutorials that accompany the product in the form of electronic documentation. This will allow you to get familiar with some of the basic organization of the Carlson Survey product before attempting the geoid creation process described below.

2. Using some other means (*i.e.* Google Earth), determine the bounding limits in terms of longitude (CAD “X” direction) and latitude (CAD “Y” direction) in decimal degree (d.ddddddd) format for your geoid grid. For the State of Iowa, we have selected:

State of Iowa	Minimum Bound	Maximum Bound	Delta
Longitude (E)	263.26666666° (263°16')	269.95000001° (269°57')	6°41'
Latitude (N)	40.28333333° (40°17')	43.60000001° (43°36')	3°19'

Table 1 - Bounds for the State of Iowa

3. Using any type of standard Carlson Software or CAD command, draw a closed “polyline” region using the decimal degree bounds for the geoid that have been determined earlier. The **RECTANGLE** key-in command can be used if available:

Command: rectangle (press *Enter*)

...<Select first corner of rectangle>: 263.26666666,40.28333333 (type Min. Bounds, press *Enter*)

Other corner of rectangle: 269.95000001,43.60000001 (type Max. Bounds, press *Enter*)

**Note**

It is suggested you add a fractional amount to the Maximum Bound limits to allow grid squares to form entirely within the polyline boundary.

The result should be a rectangular polyline that encompasses the desired geoid work area.

### Draw the Geoid Grid

Menu Location: Surface ⇒ Draw 3D Grid File

Keyboard Command: plotgrid

1. From the Surface menu, click **Draw 3D Grid File**. The Select Grid File dialog box appears as shown below.

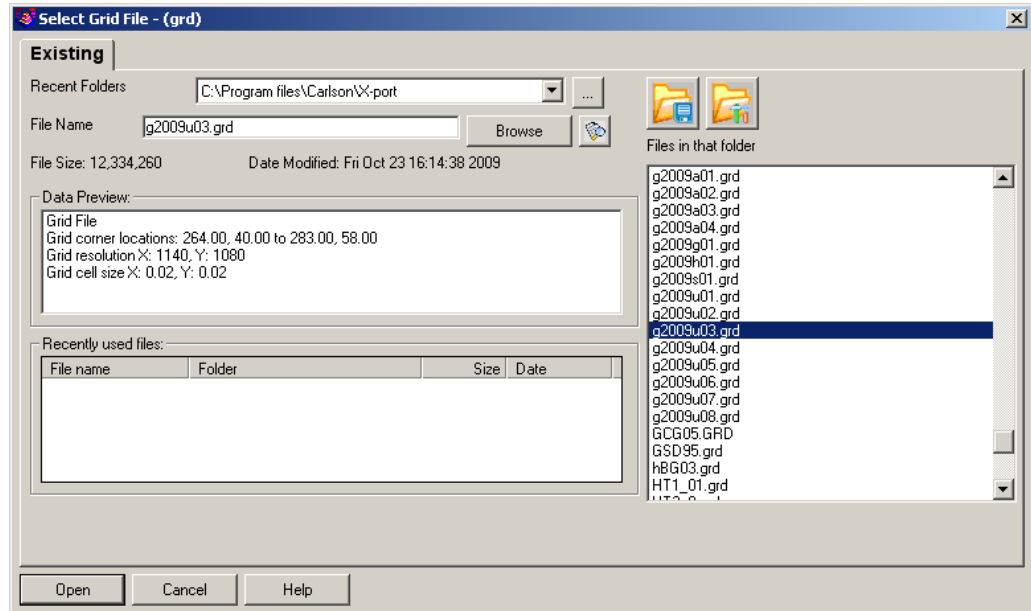


Figure 1 – Select Grid File

2. Using the **Browse** feature, locate the primary grid file that was downloaded and installed to your computer. In our example, we wish to place the contents of the **g2009u03.grd** file into our drawing. Highlight the desired file and click the **Open** button.
3. The Draw 3D Grid File dialog box appears. Set the values according to the dialog box paying particular attention to the “**Use Inclusion/Exclusion Perimeters**” toggle that should be enabled. Click the **OK** button when ready.

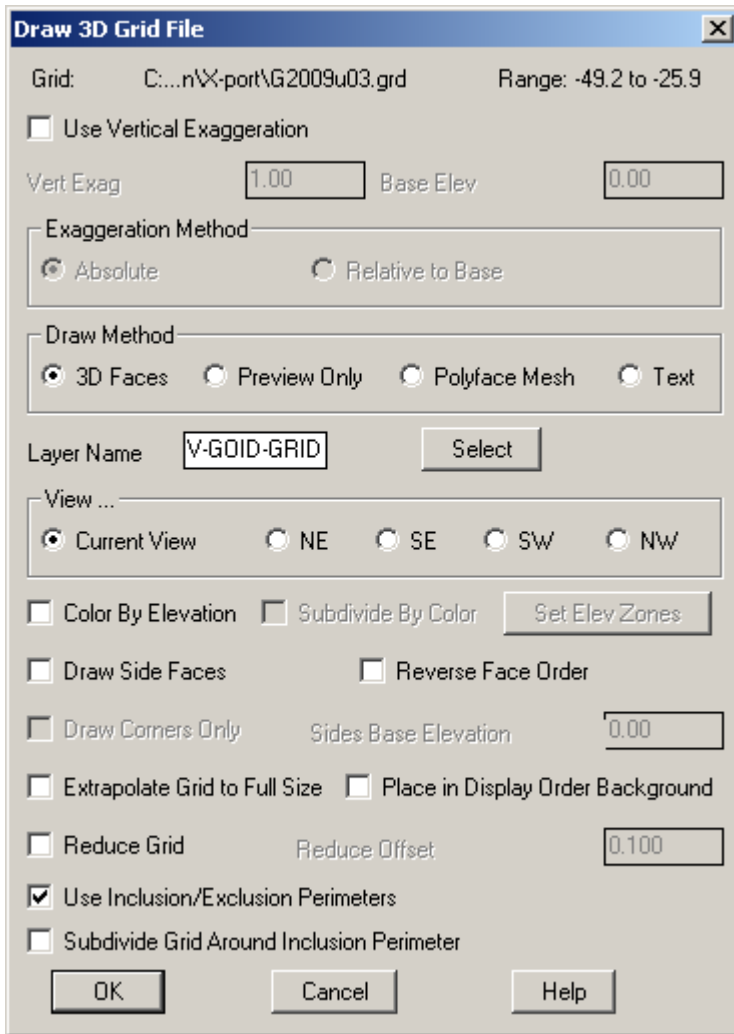


Figure 2 – Draw 3D Grid File

4. At the Command prompt, you will be prompted:

Select the Inclusion perimeter polylines or ENTER for none.

Select entities:

Select the rectangular polyline drawn earlier and press **Enter** when it has been selected.

5. At the Command prompt, you will be prompted:

Select the Exclusion perimeter polylines or ENTER for none.

Select entities:

Do not select anything graphically and press **Enter**. Geoid grid cells that lie completely within the perimeter boundary are placed into the drawing.

### Note

As it turns out, the State of Iowa is actually covered by two separate NGS geoid zones, Region 3 (which we just placed) and Region 2. To complete the full geoid for the State of Iowa, re-run the steps in this section and specify the **g2009u02.grd** file.

### Note

Although there is a 2° overlap between adjacent NGS geoid regions, it is not necessary to filter out or delete the duplicated geoid cells in the overlap region(s).

#### Isolate the Geoid Grid

Menu Location: View ⇒ Isolate Layers  
Keyboard Command: isolate

Before we create a new grid file, it is important to only have the grid cell layer(s) visible in the drawing.

1. From the View menu, click **Isolate Layers**.
2. At the Command prompt, you will be prompted:

Select objects on layers to isolate.

Select entities:

Select a grid cell entity drawn earlier and press **Enter** when it has been selected.

3. All other layers in the drawing are placed into a “frozen” state leaving just the geoid grid layer (*e.g.* V-GOIID-GRID) thawed and visible.

#### Make the Geoid Grid

Menu Location: Surface ⇒ Make 3D Grid File  
Keyboard Command: mkgrid

Before we create a new, composite grid file, we should determine the change in longitude (X-direction) and change in latitude (Y-direction) of our grid region.

As shown in Table 1 above and replicated in Table 2 below, the following Delta values are expressed and derived below:

State of Iowa	Delta in DMM	Delta in Arc-Minutes
Longitude (E)	6°41'	6*60+41= <b>401</b>

---

Latitude (N)	3°19'	3*60+19=199
--------------	-------	-------------

---

Table 2 - Deltas for the State of Iowa

We will use the arc-minute values to produce our new grid file.

1. From the Surface menu, click **Make 3D Grid File**. The Grid File to Create dialog box appears as shown below.

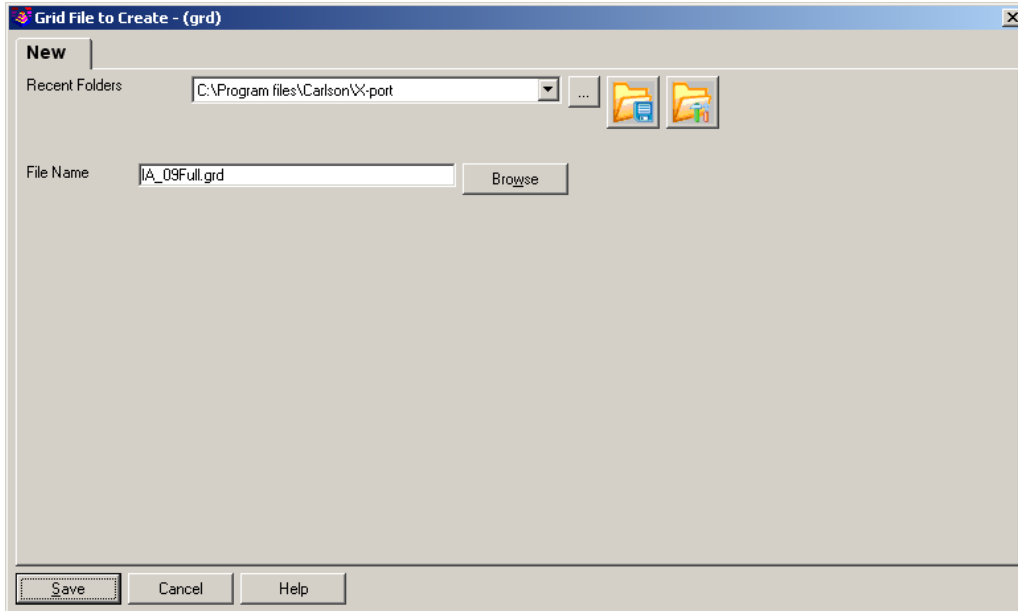


Figure 3 – Grid File to Create

2. Specify the desired name of the grid file and click the **Save** button. The **Make 3D Grid File** dialog box appears.

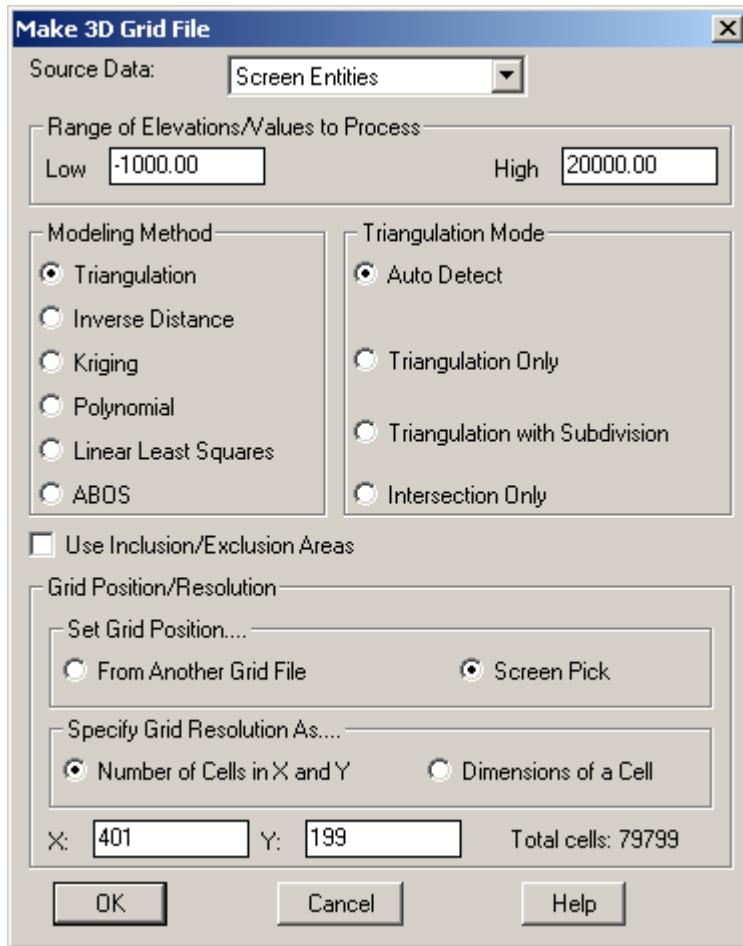


Figure 4 – Make 3D Grid File

### Note

Set the Grid Resolution for the X and Y directions to be the arc-minute Delta values for longitude and latitude, respectively. In our example, these values were cited in Table 2.

3. Set the values as shown in the dialog box shown above and click the **OK** button when complete.

4. At the Command prompt, you will be prompted:

Pick first grid corner <xxx.xxx,yy.yyyy>:

Use an endpoint snap to select the lower left limit of the grid cells.

5. At the Command prompt, you will be prompted:

Pick opposite grid corner <xxx.xxx,yy.yyyy>:

Use an endpoint snap to select the opposing corner of the grid cells.

6. At the Command prompt, you will be prompted:

Select points, lines, polylines and faces to grid from.

Select entities:

Select the 3DFACE grid entities that have been placed into the drawing. To quickly select the entire drawing, type **ALL** and press the **Enter** button twice. The result is a composite Carlson Grid (GRD) file of the geoid cells.

#### File Wrap-up

Our grid file is essentially ready for use in Carlson SurvCE. To complete the process, perform the following steps:

1. Open the GRD file with an ASCII file editor such as Notepad or Notepad++ (<http://notepad-plus.sourceforge.net>) and scroll to the bottom of the file to remove the benign footnote metadata entries as highlighted below.

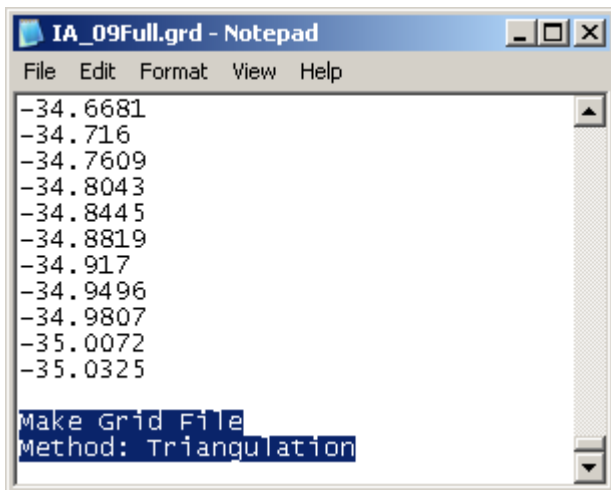


Figure 5 – Notepad

2. Issue a File → **Save As** command or use standard Windows functionality to rename the file extension from GRD to GSF as shown below.



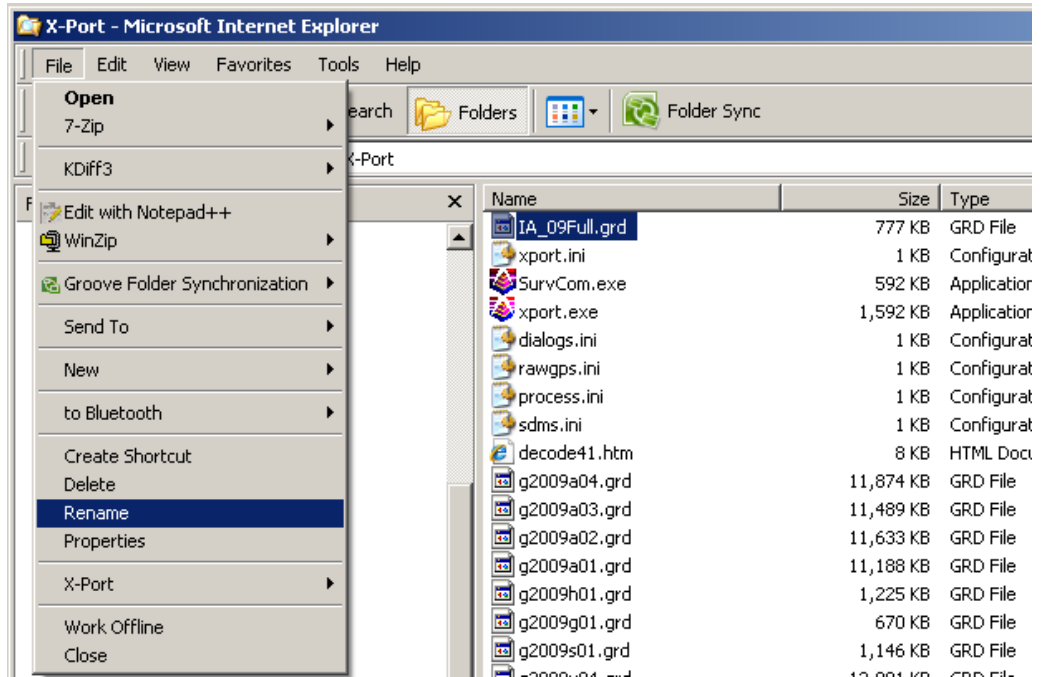


Figure 6 – Windows Explorer Rename

### Note

To gain access to the file extension, you may need to disable the “**Hide extensions for known file types**” option. From the Windows Explorer **Tools** menu, click **Folder Options**. Then from the View tab, make sure the check box toggle for “**Hide extensions for known file types**” is clear.

- Once the file has been renamed, you can use any of the available Data Transfer tools to migrate it to the **\Program Files\SurvCE\Data** folder of the Carlson Surveyor+.

### Summary

This chapter has described the process by which custom-sized geoids can be produced in Carlson Survey for use within Carlson SurvCE.